REMARKS

Following the amendments contained herein, Claims 1-20 are pending in this Application.

Claims 1-17 were previously pending in the Application. Independent Claim 1 and dependent Claims 3, 6, 7, 12, 15, and 16 are "Currently Amended" in this Response. Dependent Claims 18-20 are "New" in this Response.

Claims 1-7, 9, and 11-16 were rejected under 35 U.S.C. 102 in the Office Action dated September 16, 2005 as being anticipated by U.S. Patent No. 4,842,287 (Weeks).

Claims 1-17 were rejected under 35 U.S.C. 103(a) in the Office Action dated September 16, 2005 as being unpatentable over U.S. Patent No. 3,830,508 (Endicott) in view of U.S. Patent No. 3,403,717 (Lemelson).

During the telephone interview held on December 14, 2005, proposed amendments to Claim 1 in response to these rejections were discussed by Examiner Pickard and Terrence Kuharchuk. These proposed amendments were contained in a document entitled "Application No. 10/769,761 - Proposed Amended Claims - December 14, 2005" which was provided to Examiner Pickard before the telephone interview.

At the conclusion of the telephone interview, it was suggested by Examiner Pickard that the proposed amendments to Claim 1 may overcome the rejection based upon 35 U.S.C. 102 and Weeks, but likely would not overcome the rejection based upon 35 U.S.C. 103(a) and Endicott and Lemelson.

As a result, amended independent Claim 1 as contained in this Response includes the substance of the proposed amendments discussed during the telephone interview, as well as additional amendments which have been added specifically to address further the rejection based upon 35 U.S.C. 103(a) and Endicott and Lemelson.

Support in the specification for the substantive amendments to Claim 1 is as follows:

1. "...so that the seal assembly defines a first side of the seal assembly and a second side of the seal assembly and so that the first side is sealed from the second side by the seal assembly, the component defining a longitudinal axis of rotation and the component extending through the seal assembly between the first side and the second side of the seal assembly..."

   Support for this amendment is found in Figure 1 and in the Specification as originally filed at page 8, line 9 to page 9, line 3;

2. "...wherein the seal element is comprised of a planar seal engagement surface, and wherein the seal housing is comprised of a planar housing engagement surface..."

   Support for this amendment is found in Figures 1-3 and in Claim 1 as originally filed, where reference is made to the seal engagement surface and the housing engagement surface: "...being oriented in a plane normal to the longitudinal axis of rotation of the component..."; and

3. "(c) the seal element being exposed to a fluid pressure on the second side of the seal assembly such that an engagement force is exerted between the planar seal engagement surface and the planar housing engagement surface in order to press the compressible material into the depression and thereby restrain movement of the seal element relative to the seal housing."

   Support for this amendment is found in Figure 1, at page 8, lines 22-24, and at page 14, line 15 to page 15, line 13 of the Specification as originally filed.

Support in the Specification for the amendments to Claims 3, 6, 7, 12, 15, and 16 is found in Figures 1-3 and in Claim 1 as originally filed, where reference is made to the seal

engagement surface and the housing engagement surface: "...being oriented in a plane normal to the longitudinal axis of rotation of the component...".

Support for new Claim 18 is found in Figure 1 and at page 8, lines 21-27 of the Specification as originally filed.

Support for new Claim 19 is found at page 8, line 29 to page 9, line 18 and at page 14, line 11 to page 15, line 22 of the Specification as originally filed.

Support for new Claim 20 is found at page 14, lines 19-21 of the Specification as originally filed.

The Applicant's Invention

The Applicant's invention is directed at an improvement in a seal assembly comprising a seal element retained by a seal housing, wherein one of the seal element and the seal housing is comprised of a compressible material, wherein the seal element is comprised of a seal engagement surface, and wherein the seal housing is comprised of a housing engagement surface for engaging the seal engagement surface.

The improvement in the seal assembly which is the subject of independent Claim 1 is that one of the seal engagement surface and the housing engagement surface is comprised of the compressible material and the other of the seal engagement surface and the housing engagement surface defines a depression for providing an isolated gap between the seal engagement surface and the housing engagement surface.

The depression may be comprised of a single isolated depression or may be comprised of a depression pattern. The depression pattern may be comprised of one or more grooves.

The isolated gap provides an isolated space into which the compressible material may be pressed under the influence of pressure acting on the seal element, thus providing a

frictional force and perhaps a shear resistance which counteracts the forces which may tend to move or distort the seal element.

The gap is isolated so that the interface between the seal engagement surface and the housing engagement surface effectively seals the gap on all sides in order to trap low (atmospheric) pressure air in the gap while the seal assembly is being assembled. The presence of this low pressure air in the gap enables the pressure acting on the seal element to press the compressible material into the gap while the seal assembly is in service.

U.S. Patent No. 4,842,287 (Weeks)

This patent teaches a pressure seal for containing helium within a cryogenic refrigerator which utilizes a linear drive assembly. More specifically, the pressure seal seals the linear drive assembly from the external atmosphere.

The pressure seal includes a soft metallic gasket (30) formed of copper or some other soft metal which is contained between a plate (31) and a flange (32). The plate (31) includes serrations (37) and the flange (32) includes opposing serrations (29), so that the serrations (37,29) contact opposite sides of the gasket (30).

During assembly of the pressure seal, the plate (31) and the flange (32) are forced together in order to sandwich the gasket (30) between the serrations (37,29). This causes the gasket (30) to be deformed with grooves which match the serrations (37,29). The labyrinth of serrations (37,29) and grooves provides a seal against the passage of helium from the linear drive assembly.

The plate (31) further includes an axial support wall (35) which counters radial forces exerted on the gasket (30) due to pressure within the linear drive assembly.

It is noted that Weeks does not teach, describe or suggest providing serrations or a depression in the axial support wall (35).

Furthermore, the pressure seal described in Weeks is intended for use as a static seal and not as a dynamic seal, since the plate (31) and the flange (32) do not move relative to each other during the operation of the linear drive assembly.

It is therefore respectfully submitted that the rejection of Claims 1-7, 9 and 11-16 under 35 U.S.C. 102 as being anticipated by Weeks is overcome by the amendments made to independent Claim 1, for the following reasons.

First, the seal assembly as claimed in Claim 1 is specifically adapted for use for sealing with a rotatable component, which rotatable component extends through the seal assembly between the first side and the second side of the seal assembly. In contrast, the pressure seal in Weeks is a static seal which provides a seal between two components of a stationary housing and an external environment. Although the pressure seal in Weeks could be configured for use with a rotatable component instead of with a reciprocating linear drive assembly, it would in such a configuration continue to be a static seal.

Second, the gasket (30) in Weeks is formed from a soft metal such as copper, which although deformable, would not be usable as the compressible material described in amended Claim 1, which must be capable of being pressed into the depression upon exposure of the seal element to a fluid pressure.

U.S. Patent No. 3,830,508 (Endicott)

This patent teaches a shaft seal for providing a seal between a housing (32) and a rotating or reciprocating shaft (34). The seal includes a seal member (38), a spacer member (40) for engaging the seal member (38), and a bias means (42) for applying a force against the spacer member (40).

The seal member (38) and the spacer member (40) are configured so that an axial force provided by the bias means (42) is resolved into an axial force component and a radial force component, thus causing the spacer member (40) to urge the seal member (38) into engagement with both the housing (32) and the shaft (34). More specifically, a back surface (64) of the seal

member (38) is urged into engagement with the housing (32) at the end of an annular hole (36) and a lip (51) defined by the seal member (38) is urged into engagement with the shaft (34) by the interaction of the seal member (38) and the spacer member (40).

The seal described in Endicott is described as an improvement over prior art seals in which an axial force and a radial force for retaining a seal member in a sealing position must be provided by two separate springs or biasing means. This improvement is described as being particularly advantageous in sealing applications where there is limited space available to provide two separate biasing means.

Endicott does not teach, describe or suggest, for any purpose, providing a depression in either the back surface (64) of the seal member (38) or in the adjacent wall of the annular hole (36).

As a result, it is respectfully submitted that from the teachings of the Endicott patent there would be no motivation to modify the seal described in Endicott to incorporate a depression in either the back surface (64) of the seal member (38) or in the end of the annular hole (36) which is formed in the housing (32).

U.S. Patent No. 3,403,717 (Lemelson)

This patent teaches a sealing and bonding assembly which includes a first rigid base member (10, 10', 31 or 40) and a second member (36 or 46).

The first member (10, 10', 31 or 40) includes a lip (22 or 22') which protrudes outwardly beyond a bearing surface (12) of the first member (10, 10', 31 or 40). In one embodiment, the lip (22 or 22') is formed first, by forming or cutting a first groove or channel (14) and a second channel (16) such that the lip is formed between the channels (14, 16) and second, by bending the lip (22 or 22') downward so that it protrudes below the bearing surface (12). In a second embodiment, the first member (10, 10', 31 or 40) is directly machined or formed to provide the lip (22 or 22') so that it protrudes below the bearing surface (12).

In the application of the seal, the bearing surface (12) is brought towards the second member (36 or 46) so that the lip (22 or 22') is bent and thus provides a restoring force against the second member (36 or 46). Depending upon the shape of the lip (22 or 22') and upon the material of the second member (36 or 46), the lip (22 or 22') may or may not deform into the second member (36 or 46).

As a result, the primary function of the channels (14, 16) is to provide the lip (22 or 22'). A secondary function of the channels (14, 16) is to serve as volumes into which material of the second member (36 or 46) may flow when the bearing surface (12) is brought flush against and is deformed into the second member (36 or 46), thus causing displacement of material of the second member (36 or 46) by the lip (22 or 22').

It is suggested in the Lemelson patent at column 2, lines 45-61 that embodiments in which the lip (22 or 22') deforms into the second member (36 or 46) are suitable only for static sealing applications.

It is indicated at column 2, lines 61-63 that the seal may be applicable to dynamic or rotary sealing applications, but no direction is provided in the Lemelson patent for adapting the seal for use in such applications. In particular, no direction is given in the Lemelson patent as to the material which would be used for the second member (36 or 46) in dynamic or rotary sealing applications.

In fact, the material from which the second member (36 or 46) is constructed is not specified at all in the Lemelson patent. In embodiments where the lip (22 or 22') does not deform into the second member (36 or 46), it appears that the first member (10, 10', 31 or 40) and the second member (36 or 46) could both be formed from the same material. In embodiments where the lip (22 or 22') does deform into the second member (36 or 46), it appears only that the second member (36 or 46) should be formed from a material which has a hardness less than that of the first member (10, 10', 31 or 40) (see Claim 4 of the Lemelson patent).

In either case, Lemelson does not teach, describe or suggest that the material of the second member (36 or 46) is such that it will flow into the channels (14, 16) unless the material is

displaced by the deformation of the lip (22 or 22') into the second member (36 or 46). As a result, in the presence of a depression as claimed in Claim 1 instead of the lip (22 or 22') of Lemelson, the invention described in Lemelson would function completely differently and would perhaps not function at all, depending upon the choice of material for the second member (36 or 46).

It is therefore respectfully submitted that the rejection of Claims 1-17 under 35 U.S.C. 103(a) as being unpatentable over Endicott in view of Lemelson is overcome by the amendments made to independent Claim 1, for the following reasons.

First, Lemelson specifically requires a bearing surface (12) with a protruding lip (22 or 22'), while the Applicant's invention as claimed in Claim 1 requires a planar engagement surface and a depression. Although the material of the second member (36 or 46) in Lemelson may flow into the channels (14, 16), this is a result of displacement of material of the second member (36 or 46) by the lip (22 or 22'), and is not due to pressure being exerted on the first member (10, 10', 31 or 40). The displacement of material of the second member (36 or 46) and its flowing into the channels (14, 16) is clearly not an essential feature of the seal taught by Lemelson, since Lemelson contemplates embodiments where the lip (22 or 22') is not deformed into the second member (36 or 46).

Second, although Lemelson does contemplate a deformable material for the second member (36 or 46), Lemelson does not appear to contemplate a compressible material of the type required in amended independent Claim 1, where the compressible material is pressed into the depression upon exposure of the seal element to a fluid pressure. Instead, Lemelson appears only to contemplate materials for the second member (36 or 46) which either do not permit deformation of the lip (22 or 22') into the second member (36 or 46) or which have a hardness which is less than that of the first member (10, 10', 31 or 40).

Third, although Lemelson does suggest at column 2, lines 61-63 that the sealing and bonding assembly may "[be] applicable to dynamic or rotary sealing functions involving shafts and the like.", Lemelson provides no description of how to use the sealing and bonding assembly in a configuration which would be analogous to the seal taught by Endicott.

Specifically, if the sealing and bonding assembly of Lemelson were employed in the Endicott seal, it is unlikely that the biasing means (42) in Endicott would be capable of providing a sufficient engagement force to deform the lip (22 or 22') of Lemelson into the seal member (38) of Endicott so that the back surface (64) of the seal member (38) is fully engaged with the end of the annular hole (36) in the housing (32). If the back surface (64) of the seal member (38) is not fully engaged with the end of the annular hole (36), then fluid will be able to infiltrate the interface between the seal member (38) and the housing (32) and may cause the seal to fail.

Failure of the seal would be even more likely if the sealing and bonding assembly of Lemelson were employed in the seal assembly which is described in amended Claim 1, since the seal assembly which is described in Claim 1 does not require a preloading mechanism analogous to the biasing means (42) described in Endicott, essentially ensuring that the planar seal engagement surface and the planar housing engagement surface of the invention will not be fully engaged with each other and thus essentially ensuring that fluid will be able to infiltrate the interface between the planar seal engagement surface and the planar housing engagement surface.

In contrast, the use in the invention as claimed in amended Claim 1 of a planar seal engagement surface and a planar housing engagement surface, with a depression formed in one of them, essentially ensures that the planar seal engagement surface and the housing engagement surface will be fully engaged while providing the isolated gap into which the compressible material may be pressed under the influence of fluid pressure.

Summary

As a result of the amendments contained herein and the above remarks, it is respectfully submitted that amended independent Claim 1 is patentable and allowance of independent Claim 1 is respectfully requested.

Dependent Claims 2 - 20 all depend directly or indirectly from independent Claim 1. Thus, it is further respectfully submitted that the dependent Claims are allowable for the reasons supporting the allowability of amended independent Claim 1, as well as for the distinctions defined therein. Therefore, allowance of Claims 2-20 is also respectfully requested.

In view of the foregoing remarks, it is submitted that this Application is in condition for allowance and allowance is respectfully requested.

Respectfully submitted,
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